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DUST SEAL
[DUST SEAL]

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[Claims]

1. A dust seal for sealing between a panel that has an opening and a shaft that penetrates said panel with a panel securing member that is secured on said opening of said panel, wherein said panel securing member is generally parallel to a shaft and being cylindrical; the dust seal is integrally molded and comprises a cylindrical shaft sealing section that tightly contacts with said shaft and a plurality of bellows sections that extends in a radial direction; the plurality of the bellow sections are joined to the shaft sealing section at any inner circumferential edge and secured to said panel securing member at the outer circumferential edge; and enclosed space is formed by said shaft sealing section, said plurality of bellows sections, and said panel securing member.

2. The dust seal according to Claim 1, wherein protruding direction of the maximum protrusions in the shaft direction of two outermost bellows sections in the shaft direction are opposite to each other and directions that are away from each other.

3. The dust seal according to Claim 1, wherein one outermost bellows section in the shaft direction among the plurality of bellows sections has a groove at the outer

circumferential edge and the groove is formed being opened towards the other bellows section, and the bellows section has a rib at a surface of the outermost edge in the radial direction at said outer circumferential edge, and the groove is fitted and secured by rotating for 90 degrees the outer circumferential edge such that the opening of the groove directs the shaft.

[Detailed description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a dust seal, which can be easily incorporated and has an improved sealing property and a noise insulation property.

[0002]

[Prior Art]

A steering shaft of an automobile is disposed so as to penetrate an opening of a front dash panel. A dust seal is provided between at an opening end and a steering shaft. The dust seal is for separating between the inside and the outside of car room, shields from trash, dust, water, and so on from the outside, and also shields engine noise. In addition, since displacement of a steering shaft in relative to the opening of the front dash panel during

traveling is unavoidable, a dust seal has to follow the movement and also has to keep the sealing property.

[0003]

In a dust seal of this type, there is disclosed a technique of a dust seal in Unexamined Japanese Patent Application Publication 9-242880, which is a sealing device including: a first dust seal member that has a sealing section that contacts with a stationary annular section secured at an opening of a front dash panel and a shaft and a bellow section that connects between the stationary annular section and a sealing section; and a second dust seal member that has a sealing section that contacts with a stationary annular section to be fitted in the stationary annular section of the first dust seal member and a shaft and a bellow section that connects between the stationary annular section and the sealing section. Furthermore, Fig. 7 shows a cross-section of another conventional dust seal that includes two dust seal members [21] and [22].

[0004]

[Problems to be Solved by the Invention]

However, the above-described technique has the following problems.

[0005]

Since two dust seal members are fitted and then incorporated in a steering shaft and a front dash panel, it is troublesome to put together. In addition, since two members are fitted to assemble, its sealing property and noise insulation property are slightly inferior.

[0006]

In view of the above problems, there is provided an invention, an object of which is to provide a dust seal that can be easily installed to a car body, can improve sealing property and noise insulation property, and can reduce the cost.

[0007]

[Means to Solve the Problem]

More specifically, the invention of Claim 1 of this application is a dust seal that is secured at an opening between a panel having an opening and a shaft that penetrates the panel at the opening and seals with a panel securing member. The panel securing member is generally parallel to the above-described shaft and cylindrical, and the dust seal is integrally molded and has a cylindrical shaft seal section that tightly contacts with the shaft and a plurality of bellow sections that extend in the radial direction. As for the plurality of bellow sections, any inner circumferential edge is joined to a shaft seal

section, and the outer circumferential edge is adhered onto the panel securing member, and a air-tightly sealed space is formed by the shaft seal section, the plurality of bellow sections, and a panel securing member.

[0008]

A dust seal having a shaft seal sections and a plurality of bellow sections is integrally molded, and the dust seal is formed from one member. For this reason, in comparison with forming a dust seal combining two members, there are the following advantages.

[0009]

First, installation to a car body can be done easily, if a dust seal is made of two members, it is necessary to perform two works, i.e. a work to put the members together and a work to install to a car body, and extra caution has to be paid to relative positions of the members. On the other hand, if a seal is made from one member, it simply needs to be installed onto a car.

[0010]

Second, the sealing property and the noise insulation property can be improved. If two members are combined, there is unavoidable concern of entrance of alien substances such as dust, water, and oil. In addition, because of space between the members, penetration of engine

noise cannot be completely prevented. If a dust seal is made from one member, the sealing property is improved and there is no concern of entrance of alien substances. Moreover, since noise insulation property can be improved, insulation from engine noise can be improved.

[0011]

Third, the manufacturing cost can be reduced. Since molding has to be done once and installation work is simpler, the cost can be reduced.

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[0012]

The plurality of bellows sections, which extend in the radial direction, is joined to the shaft sealing section at the inner circumferential edge and adhered to the panel securing member at the outer circumferential edge, so as to form enclosed space. Since the enclosed space is formed by the dust seal, the panel securing member, and adhesion therebetween, the enclosed space is highly sealed and entrance of alien substances and penetration of noises can be prevented.

[0013]

In addition, since the panel securing member is generally parallel to the shaft and is cylindrical, wide and stable enclosed space can be formed with the dust seal.

[0014]

Since the dust seal is required to have a sealing property, a noise insulation property, flowability to shaft movement, and so on, it is preferably made of rubber or plastic.

[0015]

The invention of Claim 2 of this application is the dust seal according to Claim 1, which is characterized by that protruding directions of the maximum protrusion in the shaft direction of the two bellows sections at the outermost side in the shaft direction are opposite to each other and away from each other.

[0016]

The bellows sections are creased like waves as shown in Fig. 3 so as to follow relative movement to the shaft and the opening. For this reason, the bellows sections have at least one protruding section in the shaft direction. The protruding direction is the shaft direction. If the protruding directions of the maximum protrusions of the two of the plurality of bellow sections, which are at outermost positions in the shaft direction, are opposite to each other or directions that are away from each other, the enclosed space surrounded by the two bellows sections, i.e. the enclosed space formed by the dust seal and the panel

securing member, has larger volume than that when the protruding directions are same or are close to each other. For this reason, the noise insulation property can be improved.

[0017]

The invention of Claim 3 of this application is the dust seal according to Claim 1, which is characterized by that an outer circumferential edge of one bellows section at the outermost side in the shaft direction has a groove, the groove is formed so as to be opened to the other bellows section, a rib is provided on a surface of an outermost edge in a radial direction of the outer circumferential edge, the bellows section is secured by rotating the outer circumferential edge for substantially 90° such that the opening of the groove faces the shaft and fitting the groove in the panel securing member.

[0018]

With this structure, assembly is easy and molding with a die is easy. Since a molding die is opened/closed by movement of an upper die and a lower die in the vertical direction of Fig. 6, if the opening of the groove faces the fitting section (a flange section [12] of the panel securing member [5] of Fig. 6) of the panel securing member from the beginning, i.e. the shaft direction, the die slips

into the groove in a direction perpendicular to the moving direction of the die, so that the dust seal will not be released from the die even the dies are opened. On the other hand, according to this invention, since the opening of the groove faces the other bellow section and the direction is identical to the moving direction of the dies, the dies can be easily released.

[0019]

Upon fitting the outer circumferential edge of the bellows section and the panel securing member, they can be simply fitted without using adhesive, but since the adhesion strength and air-tightness can be improved if they are adhered using adhesive, it is preferred. For an adhesive to use, an epoxy or urethane adhesive can be preferably used.

[0020]

In addition, since a surface of the outermost edge of the outer circumferential edge has a rib, dies can be easily released upon molding. If the outermost edge surface does not have a rib and is flat, die is stained by friction against a die at this portion upon taking the dust seal from the dies after molding, and release from the dies is impaired. Accordingly, if molding is repeated as is, a dust seal of the molded article sticks to the dies, and has

to be damaged upon taking out from the dies. Since the dust seal can be released from the dies being peeled therefrom by rotation of the outer circumferential edge part left at the end on the upper die upon taking out from the dies if it has a rib, the dies will not be stained so much and rubber will not adhere.

[0021]

The shape or the number of ribs can be any as long as the dust seal can be easily released from the dies upon molding.

[0022]

[Effects of the Invention]

Because of the above-described constitution, the present invention has the following effects.

[0023]

Since a dust seal having a shaft sealing section and a plurality of bellows sections is produced by integral molding and is made as one-piece member, installation work to a car body can be easily performed and the manufacturing process of the dust seal can be simplified and thereby the cost can be reduced.

[0024]

The plurality of bellows sections is joined to the shaft sealing section at any inner circumferential edges,

and adhered to a cylindrical panel securing section at the outer circumferential edge, and thereby enclosed space is formed by the shaft sealing section, the plurality of bellows sections, and the panel securing member, the sealing property and noise insulation property are improved.

[0025]

Since the protruding directions of the maximum protrusions of the two bellows sections in the shaft direction, which are outermost side in the axial direction, are opposite to the pother or in a direction of being away from each other, the noise insulation property can be improved.

[0026]

Since the bellows sections are fitted to the panel securing member by providing a groove and rib at the outer circumferential edge of one bellows section, molding is easy and assembly can be also simplified.

[0027]

[Embodiments of the Invention]

Hereunder, embodiments of the invention will be described referring to drawings.

[0028]-First Embodiment-

Fig. 1 is a cross-sectional view of a dust seal [4] of a first embodiment. The dust seal [4] has a cylindrical

shaft sealing section [3] that has a shaft insertion opening on the inner side and two bellows sections [1] and [2], which are joined to the shaft sealing section [3] and extend outward in the radial direction. The two bellows sections [1] and [2] are adhered to a cylindrical panel securing member [5] at the adhering sections [7] and [8].

[0029]

On the inner side of the shaft sealing section [3], a first and a second annular lips [13] and [14] are provided so as to enhance the sealing property.

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In addition, since the second lip [14] having a plurality of small recesses and protrusions holds grease in the recesses, has a function of reducing the sliding resistance against the shaft. An annular metal fitting [6] is embedded in the dust seal [4] and also has a function of supporting.

[0030]

The bellows sections [1] and [2] joined to the shaft sealing section [3] and the panel securing member [5] in a state of having flexibility so as to be able to follow movement of the shaft even if the shaft displaces in the eccentric direction or in the shaft direction.

[0031]

Next, a manufacturing method will be described, but the method described below is an example and a method of manufacturing a dust seal of the invention shall not be limited by the example.

[0032]

A primer adhesive is applied onto a portion of the panel securing member [5] to adhere with an adhering section [8] of the second bellows section [2], and then an overcoating adhesive is applied thereon. Similarly, the primer adhesive is applied on a surface of the annular metal fitting [6], and then overcoating adhesive is applied thereon. For those primer adhesives, phenol adhesive (e.g. Chemlok 205 (product name) manufactured by Hughson Chemical Co., U.S.A.) may be preferably used and rubber chloride-based adhesive (e.g. Chemlok 220 (product name) manufactured by Hughson Chemical Co., U.S.A.) may be preferably used as the overcoating adhesive.

[0033]

Putting the panel securing member [5] and the annular metal fitting [6] in the dies and injecting rubber, molding is performed. The panel securing member [5], the annular metal fitting [6], and rubber are adhered by vulcanization. The rubber used herein includes natural rubber (NR), styrene-butadiene rubber (SBR), NR/SBR, chloroprene rubber

(CR), ethylene-propylene rubber (EPDM), and acrylonitrile butadiene rubber (NBR).

[0034]

A molded piece that is molded and then taken out from the die is the one shown in Fig. 2. At this time, if the adhered portion [7] of the first bellows section [1] is lightly pressed from the upper side, deflection, the maximum protrusion [9] of the first protrusion [1] shown in Fig. 1, is formed. Adhering the adhering section [7] of the first bellows section [1] of the dust seal [4] and a flange [12] of the panel securing member [5] with epoxy or urethane adhesive, the dust seal [4] of Fig. 1 can be completed.

[0035]

Applying grease on the inner side of the shaft sealing section [3] of the dust seal [4], the steering shaft is inserted and then the panel securing member [5] is attached to the dash panel.

[0036]-Second Embodiment-

Fig. 3 is a cross-sectional view of the dust seal [4] of the second embodiment. Differences from the first embodiment are the protruding direction of the maximum protrusion [9] of the first bellows section [1]. In Fig. 3, the protruding direction of the maximum protrusion [9] of

the first bellows section [1] and the protruding direction of the maximum protrusion [10] of the second bellows section [2] are opposite directions and direction of being away from each other. Therefore, space surround by those two protrusions [9] and [10] has larger volume than that in the dust seal [4] of Fig. 1, and the noise insulation property is higher. The second embodiment is similar to the first embodiment even in structure, manufacturing method, and installation except the protruding direction of the maximum protrusion [9] of the first bellows section [1].

[0037]-Third Embodiment-

A third embodiment is shown in Figs. 5 and 6. Fig. 6 is a sectional view of a dust seal in a state of being molded and then taken out from a die; Fig. 5 is a sectional view of a state where a fitting section [15] of the first bellows section [1] is fitted in the flange [12] of the panel securing member [5]. Hereunder, the third embodiment will be described based on the drawings, but since it includes the same portions as in the first embodiment, only difference from the first embodiment will be described below.

[0038]

A difference in Fig. 6 from the first embodiment is that a fitting section [15] to fit to the panel securing

section [5] is formed at the outer circumferential edge of the first bellows section [1]. The fitting section [15] has a groove [16] that is opened downward and has two ribs [17] around the outside. Since the direction of the opening of the groove [16] is not identical to the direction of the flange [12] of the panel securing member, the fitting section [15] is fitted to the flange [12] by rotating the fitting downward for 90° in Fig. 6. Fig. 5 shows the state. Before the fitting, an epoxy or a urethane adhesive can be also applied on the groove [16] or the flange [12]. Since the fitting section is fitted to the panel securing member [5], positioning precision is always good and the outer circumferential edge of the first bellows section [1] can be easily secured to the panel securing member [5]. At this time, the ribs [17] direct downward.

[Brief Description of the Drawings]

Fig. 1 is a sectional view of a dust seal in a first embodiment.

Fig. 2 is a sectional view of the dust seal before adhesion in the first embodiment.

Fig. 3 is a sectional view of the dust seal in a second embodiment.

Fig. 4 is a sectional view of the dust seal before adhesion in the second embodiment.

Fig. 5 is a sectional view of the dust seal in a third embodiment.

Fig. 6 is a sectional view of the dust seal before fitting in the third embodiment.

Fig. 7 is a sectional view of a conventional dust seal made of two members.

[Description of Reference Numerals]

- 1: first bellows section
 - 2: second bellows section
 - 3: shaft sealing section
 - 4: dust seal
 - 5: panel securing member
 - 6: annular metal fitting
 - 7: adhering section of the first bellows section
 - 8: adhering section of the second bellows section
 - 9: maximum protrusion of the first bellows section
 - 10: maximum protrusion of the second bellows section
 - 11: shaft insertion opening
 - 12: flange of the panel securing member
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- 13: first annular lip
 - 14: second annular lip

- 15: fitting section of the first bellows section
- 16: groove
- 17: rib
- 21: first dust seal member
- 22: second dust seal member
- 23: adhering section of the first dust seal member
- 24: adhering section of the second dust seal member

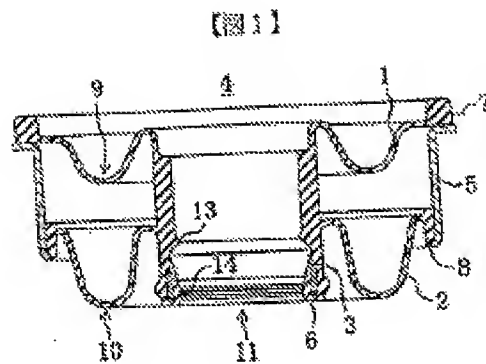


Fig. 1

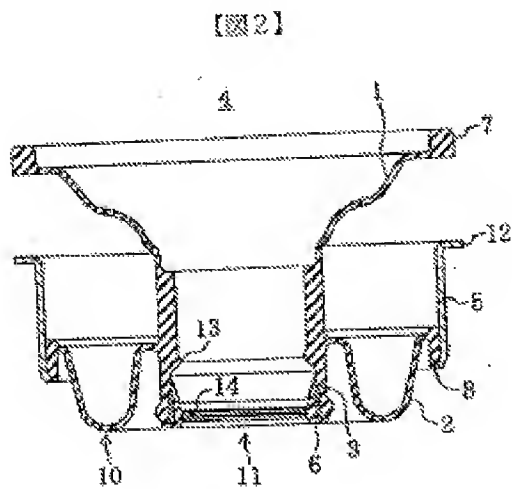


Fig. 2

【図3】

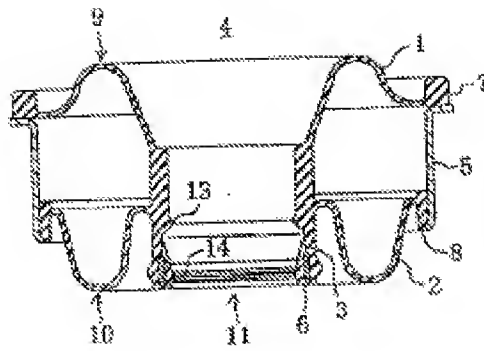


Fig. 3

【図4】

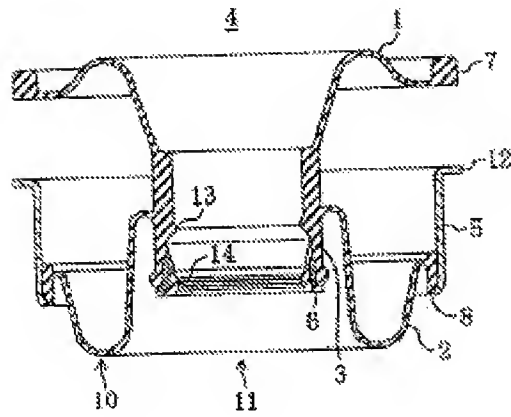


Fig. 4

【図5】

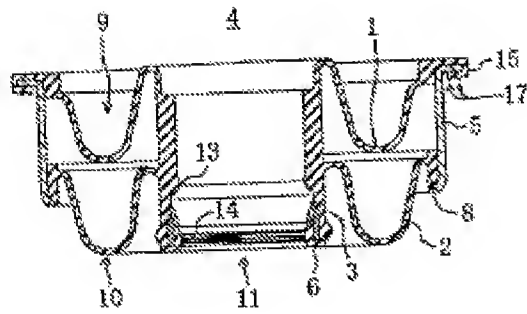


Fig. 5

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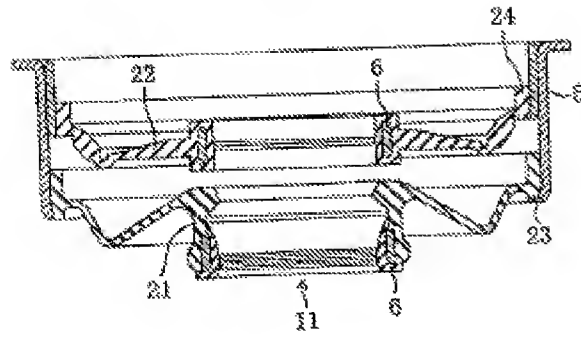


Fig. 7

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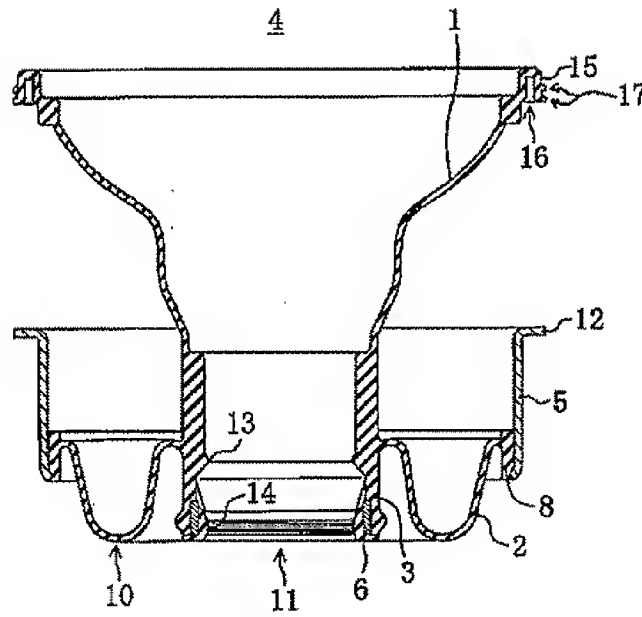


Fig. 6